THE TELEGRAPHIC JOURNAL AND ELECTRICAL REVIEW.

VOL. VII.—No. 144.

THE SOCIETY OF TELEGRAPH ENGINEERS.

ON the evening of January 22, Dr. C. W. Siemens, the retiring President, resigned the Chair of our Society to Major Bateman-Champain, R.E., who delivered his Inaugural Address. Dr. Siemens was the careful nurse of the Society while yet in its infancy, he sheltered it by his great name and fostered it by his labour, and we feel sure that its members will regret to be deprived, even temporarily, of the presence of (to apply a phrase which, in these ungenial times, has even dropped out of H. M. Letters Patent) their "trusty and well-beloved" first and latest Chairman.

The present year will be an unusual one for the Society of Telegraph Engineers. Upon it will devolve the duty of welcoming and entertaining the foreign delegates, who will sit at the first International Telegraph Congress which has ever been held in London. Major Bateman-Champain is a gentleman who has already had much experience of these Congresses, he is acquainted with many of the foreign delegates who will attend the forthcoming one, and in selecting him for their President during the ensuing Session, the Society of Telegraph Engineers have, we believe, put the right man in the right place.

The Inaugural Address of Major Bateman-Champain, which we publish in this number, will be found to contain a complete and lucid account of all previous International Telegraph Congresses, and it will be read with gratified interest in all parts of the world, not only by professional electricians, but by those not technically interested in telegraphy. It would be premature, as yet, to deal with the question of international tariffs; and we will, therefore, turn to the remarks in the address upon the prosperity of the Society itself. It is satisfactory to learn that the Society now numbers in its ranks more than a thousand members, associates, and students, and that by means of the loan generously offered by a few members, it is now "well established on a firm footing," to use Major Bateman-Champain's own words. Such are the rapid developments of electrical science now going on, that it requires no gift of prophesy to foresee a flourishing future for our Society, and we are glad to hear that, despite the straitened circumstances of the last year or two, it will enter upon 1879 with an unclouded prospect.

It appears to us, however, and we are sure we speak what is in the minds of many of its unofficial members, that there is an important flaw in the state of the Society at present, and that the Society will never be centrally strong and thoroughly alive until it is remedied. We refer to the morbid and lifeless condition of the Society's rooms. The reading-room and library of the Society, its local habitation to hundreds of its members abroad, and what should be the seat of its circulation to members at home, is practically shut. A noble library fills its shelves with literary treasures, which the visitor may admire, but is requested not to touch; its cupboards overflow with electrical periodicals, which, it may be presumed, were ordered for its reading-table, and the hardy member who dares to enter its forbidden precincts, experiences some of the uneasy emotions of an interloper. The Society of Telegraph Engineers reminds us herein of one of those antique yew trees which the adventurous traveller sometimes descries in remote rural graveyards, far from the busy haunts of men. All green and darkly beautiful to outward view, it seems to him the very embodiment of staunch (though somewhat lugubrious) life; and it is only when he comes to look inside that he discovers, and discovering mourns, the emptiness within. If the traveller be a Londoner, he will probably not be disposed to take exception to the yew tree for conforming to the first canon of Cockney morality, by keeping up a good appearance; but, if he be not likewise a fool, he will admit that it is of far more vital importance to the tree to have a sound core. We would have the rooms of the Society of Telegraph Engineers what they ought to be, a reading-room for students of electric science, a reference library for professors, and a resort for foreign members when they come to London.

In order to promote this healthy state of being, the first thing to be done is to put the library in order and open it to readers. The publication of the Ronalds' Catalogue has, we know, been a severe strain on the resources of the Society, and when finished it will, undoubtedly, be a credit to the latter; but from the way in which it has been talked about, while the books themselves have been neglected, one would think that the library merely existed in order to furnish the catalogue. The shadow has been mistaken for the substance before, and it may even be advisable for us in this case to hint that libraries are even more important than catalogues. The books of the Ronalds' Library are, we believe, to be indicated by an asterisk in the Ronalds' Catalogue, and the catalogue could be published at once if the money were in hand. But ought the library, we ask, to remain a sealed book because the

larger catalogue, of which it forms but a part, cannot be published? Certainly not. A small catalogue for the Ronalds' Library alone could be printed very cheaply for the use of members, (many of whom would purchase it who would not purchase the Ronalds' Catalogue), and the library opened for reading. Nor is even this plan necessary in order that the library may be accessible, for if a manuscript catalogue were made out and deposited in the library for reference, the works which Sir Francis Ronalds collected with love and care, might be put to some use. As supplementary to the library, the reading table ought to be kept regularly supplied with all the home and foreign electrical periodicals. A few of these are now taken in at the rooms, and, perhaps with a view of preserving their virtues unimpaired for future generations, they are speedily bundled up and stowed away. But more of these periodicals should be taken in, and they should be allowed to remain in a cut condition on the table until replaced by the next numbers.

Hitherto the Society of Telegraph Engineers has been unfortunate in not having a permanent secretary. Prior to Mr. Langdon's appointment, the secretarial work fell into arrear, and it is only due to the latter gentleman to say that, in the short term of his office, he recovered nearly all the ground that his predecessors had lost. The Society is now, however, well and fully officered, and we hope that the defects which we have indicated will soon be remedied.

We are glad to see that, thanks to the recently-appointed "Chairman of the Editing Committee," the Society's journal will be issued more frequently than before, so that a particular paper read will be in the hands of members very shortly afterwards. This step is likely to promote the welfare of the Society, and as a certain extent of scientific publicity beyond the strict bounds of the Society itself is well-known to have a similar effect, we think that the Society might do well to follow the example of other learned societies, such as the Royal Society, the Physical, the Meteorological, and the Institution of Civil Engineers, and furnish abstracts to a few of the scientific periodicals. The preparation of these abstracts would entail a little extra labour on the "Chairman of the Editing Committee," but we feel sure that this work would be a very trifling tax on the luxuriant abilities of Professor Ayrton.

With the extra task of entertaining the International Telegraph Congress upon his shoulders this year, it may be too much to ask Major Bateman-Champain to see to these internal improvements; but we can assure him that if he has time to get them carried out, he will earn the thanks of the general body of the Society.

INTERNATIONAL TELEGRAPH CONGRESSES.

The Presidential Address to the Society of Telegraph Engineers by MAJOR J. U. BATEMAN-CHAMPAIN, R.E.

AFTER alluding to the prosperity of the Society and reviewing the progress of electrical science during the past year, Major Bateman-Champain continued as follows:

Now, gentlemen, although the improvement and perfection of the apparatus and machinery in use for the transmission of messages are undoubtedly objects of the first importance to us, yet I am of opinion that, as "telegraph engineers," we may with advantage direct attention now and then to the means by which that machinery is employed and controlled.

I propose, therefore, this evening to make a few observations on the practical administration of the telegraph system, on the efficiency of which the utility of one of the most marvellous of all modern inventions very largely depends.

I am aware that the subject may be considered somewhat commonplace by many here assembled, but I must humbly own that I am fully conscious of my inability to guide you among the higher mountain paths familiar to my distinguished predecessors,—I must plod in the valley or stay at home,—and I am sensible that I owe you some explanation of the reason which led me to acccept the unmerited honour which has been conferred on me, and to adress you as your president this evening.

It is simply this. This summer will, we hope, witness the assembly in London of one of those international telegraph conferences which are held from time to time to revise, and, where necessary, to modify, the legislation accepted by the adhering States. It has been my duty to attend one or two of such conferences, and, consequently, I have gained some knowledge of the several steps which have led to the adoption of the laws now in force. I may add that it is my good fortune to be on intimate and friendly terms with many of the foreign delegates whom we hope to welcome in London, and I flatter myself that I might, as your president this session, be able to render some small service to the Society. It struck me, too, that an explanation of the past history and efforts of these conferences might not be inopportune at the opening of the year 1879.

In the early stages of the development of the electric telegraph, when the wires were gradually creeping from city to city, and when the telegraphs of each country were, so to speak, self-contained, each administration made its own rules and cared nothing for its neighbour. It was not until nearly the middle of this century that the lines of one country began to cross the frontiers and to hook on to those of the adjoining States, and international telegraphy became an established fact.

The necessity of well-defined laws for the regulation of the international traffic was immediately felt, and from comparatively small beginnings, to which I shall devote a few words, the present complete and elaborate code has been drawn up, and is now accepted over nearly the whole civilised world. The International Convention does not, of course, lay down laws for the internal traffic of the several States; one country may choose to tax its local messages by the word or even letter; a neighbouring country may, if it pleases, tax on the 20-word system and give the address free; but international messages, that is to say, messages crossing the frontiers, are all taxed and generally treated in strict accordance with Convention laws. Just as in railway administrations, one State may select for its

internal traffic a broad gauge, another a narrow, and a third the metre gauge; but directly an international system of railways comes into play, the States interested must obviously agree among themselves on a uniform standard and on uniform working rules. Nowadays, international conferences to legislate on railway, postal, eletric, and other subjects are frequent, but telegraphy was the first to be so treated, and since the date of the earliest meeting in Paris, 26 years ago, periodical assemblies have been held with considerable regularity.

Like almost everything else, these conferences had small beginnings. The original one was attended by representatives of the following Governments only: Belgium, France, Prussia, Austria, Bavaria, Saxony, Hanover, Wurtemburg, and Holland. State after State then began by degrees to join, until at the last meeting at St. Petersburg all the nations of Europe, besides three or four extra European countries, were parties to the International Telegraph Convention. From 1852 to 1858 these conferences were, comparatively speaking, rather numerous; partly because different arrangements were entered into between different groups of administrations, and partly because in those early stages of telegraph administration want of experience necessitated frequent revision and remodelling.

The dates of the eleven chief conferences which have been held are as follows:—

Paris	4th October, 1852.
Berlin	29th June, 1855.
Paris	29th December, 1855.
Brussels	30th June, 1858.
Berne	September, 1858.
Friedrichshafen ...	26th October, 1858.
Paris	18th May, 1865.
Vienna	21st July, 1868.
Berne (supplementary),	2nd October, 1871.
Rome	14th January, 1872.
St. Petersburg	...7-19th July, 1875.

The rule at present is to meet once in about three years; a conference, therefore, would in due course have assembled last year, as anticipated in the opening address of our late president; but from the disturbed condition of Europe and other causes it was postponed until the summer of 1879.

At the earlier conferences each State was represented by a diplomatic official of rank, but latterly the delegates have usually been officers of high standing in the telegraph administrations of the several countries, and these delegates have powers to agree to the generally-approved alterations, subject to eventual ratification by their respective governments. India accepted in a general way the Convention rules almost immediately after the completion, in 1864, of the Indo-European line of telegraph, which connected the Indian system with that of Europe, and she joined formally at Vienna in 1868, when Colonels Goldsmid and Glover were India's delegates at the conference. I may observe that, although it has been the custom for each State to send more than one representative official, a single vote only is granted to each distinct government.

In 1868 the telegraphs of this country were not, as now, worked by the Post Office, and, consequently, Great Britain was not represented at the Vienna Conference. The first cable between this country and the Continent was laid, I may remind you, in 1851, and the British companies soon found themselves obliged to treat their foreign traffic in accordance with the international regulations. England joined the Convention after the purchase of the inland wires from the companies, and Messrs. Chambré and Fischer, of the Post Office Telegraphs, were for the first time deputed to represent this country at the Rome Conference of 1872.

One vote was given to Great Britain and a separate one to India, in consequence of the independent character of the administrations of the two Governments and the different interests they might have in view.

It will be obviously impossible for me, within the limits assigned to a presidential address, to describe to you fully the legislation affecting international traffic and tariffs established at the different conferences; but by confining my attempts to a brief outline of the original Convention of Paris, with a sketch of two or three of the principal modifications subsequently introduced into it, and the chief provision since made to keep pace with the requirements of the times, I hope to furnish you with some materials for forming an opinion on the value of the labour expended in this particular branch of our profession. And here I would draw your attention to what appears a rather remarkable fact, that although upwards of a quarter of a century has elapsed since the first Convention was drawn up between the representatives of a few States at Paris, its enactments, so far as they go, have virtually formed the groundwork of all our subsequent legislation: a circumstance which bears emphatic testimony to the care and completeness with which they were thought out and prepared.

The main provisions of the original Convention, signed at Paris in 1852, were the recognition of the right of all persons to use the international lines on prepayment of their messages; the stipulations that messages from the public should be written in an intelligible manner; that the languages employed should be French, German, or English; and that senders should furnish proof of identity when required, and that Government messages only might be sent in cipher. The contracting states engaged that a sufficient number of wires should be set apart for international traffic; that the best instruments should be made use of; that secresy should be maintained; and that the charge for any message lost, mutilated, or seriously delayed, should be refunded. This was the limit of administrative responsibility, which has not been since extended. It was arranged that all messages should be classified and transmitted in the following order:

1. Government messages;
2. Service messages between telegraph administrations;
3. Messages from the public;

that the telegrams of each category should be signalled in the order of their deposit by the senders, or of their arrival at the intermediate stations; and that the signalling of any message once commenced should not be interrupted to give place to a despatch of superior rank, except in cases of absolute emergency. It was provided that messages stopped in consequence of interruptions of the lines should be forwarded by post; that all international offices should be open during specified hours; and that any sender should be at liberty to prepay a reply or an acknowledgment of receipt, or to have his message repeated *en route*, to ensure greater accuracy. The Governments accorded the power to other States to accede to the Convention on demand; and each reserved to itself the right to suspend the service on its lines, either altogether or for certain classes of messages, on condition of giving immediate notice to the other contracting Governments.

The unit of charge was for a standard message of 20 words, with double rates at night; and each contracting State was divided into a number of zones, with a separate charge for each zone, according to its distance from the frontier.

Considerable modifications have since been made in the length of the standard message and in the tariffs for each country. It is, as you are aware, necessary, for purposes of record and identification,

that each message should be accompanied by a preamble, giving its official number, date, place of origin, and other particulars. As the preamble is equal to 6 or 7 ordinary words, it appeared natural to those who drew up the first tariffs that a standard message should be of such a length that its cost should cover the transmission of the preamble. In the first Paris Convention, a single rate was accordingly made to apply to a standard message not exceeding 20 words in length; two rates were demanded for a message containing from 21 to 50 words, and three for a message containing from 51 to 100 words. During the next few years the standard was altered to 25 words, and then to 15 words, with a limited free address. In the Berne Convention of 1858, the latter was discontinued, and the standard was brought back to the original number of words, with half rate for each extra 10 words, and this regulation has remained in force in Europe ever since, that is to say, for about 20 years.

But although suitable for lines in Europe, where the distances are comparatively short, and the tariff moderate, it soon became evident that a 20-word standard was ill adapted to the long lines connecting Europe with India and other distant countries. These extra European lines are very costly to construct and to maintain; their traffic consists, moreover, almost entirely of messages passing between their extreme points, the business of the intermediate stations being but insignificant. The tariff on lines of this description is therefore necessarily high, and, where this is the case, merchants, who are the most important customers, soon find that they can express the bulk of their wants in messages of very much shorter length than 20 words; in fact, by arranging a number of selected words with different meanings attached to each, they are enabled to form codes by which they can convey all their ordinary enquiries, instructions, and replies in very few words indeed. To meet the demand for brief messages beyond Europe, the Vienna Convention of 1868 allowed the extra European administrations to introduce on their lines a special message of 10 words. The Rome Convention of 1872 authorised the conversion of the special message into a standard message of 10 words, with subsequent gradation of charge per single word; and the St. Petersburg Convention of 1875 swept away altogether the restriction of the 10 word minimum, and introduced on the extra European lines a word tariff pure and simple. In fact, the European administrations recognised the word measure for extra European traffic, but retained the 20-word standard in Europe. The former is, however, now meeting with much general favour and support. It has quite lately been adopted by special agreement between Germany and Great Britain, and it is not impossible that at the London Conference it may be accepted as the normal international unit. The arguments in favour of a small standard of measurement are obvious, but naturally apply much more forcibly in the case of high than in the case of low tariffs.

It is not fair to insist on a sender paying for more work than he wishes to exact, and it is to the interest of all that the charge for a message should be as nearly as possible in proportion to the time and labour expended.

A letter tariff has been suggested, and this would, perhaps, in theory be a nearer approach to perfect accuracy than the word, but in practice it would be exceedingly troublesome, and the clerical labour entailed would be excessive.

Adverting to the tariffs, which, as I previously mentioned, were based in the International Convention of 1852 on the zone principle, I would observe that, roughly speaking, the first zone of a country was about 50 miles in breadth, and the succeeding zones about 100 miles. The charge in 1852 was 2s. per zone for a standard message, and by successive reductions was brought down to about 1s. 2d. in 1858.

In 1865 was concluded the seventh Convention on my list, generally spoken of as *the* Paris Convention, though it was, as I have shown, not the first or only one drawn up in the French capital. It acquired its repute from the length of its duration and its subsequent revisions at Vienna and Rome. On this occasion the zone system was abolished, and the principle of mean rates for each country was substituted. The tariffs were also very considerably reduced, as may be seen by taking, as an example, the 20-word charge between London and Constantinople, which in 1854 was 19s., but only 9s. after the Paris Convention.

In the St. Petersburg Convention of 1875, the principle of mean rates was, at the instance of India, somewhat further extended, so that, in the case of messages exchanged with the East, a mean rate is now collected to cover the transit over any distance in Europe. This is another principle which seems to meet with growing approval, and before long we may have a mean telegraph rate of so much per word between the different States of Europe, resembling the mean rate for letters established at the Postal Union.

The question of how far the telegraph rates can be cheapened, and this costly means of communication placed within the means of a larger class of correspondents than at present, is one of the greatest interest. Mr. Edwin Chadwick, and many other gentlemen whose opinions deserve attentive consideration, think that the time has arrived when the ocean telegraphs should be purchased by the Government, and as long ago as February, 1872, a paper giving expression to these views and to the arguments in their support was circulated by the Society of Arts. An elaborate and able essay on the subject of tariffs, a translation of which appeared in the TELEGRAPHIC JOURNAL, was written not long ago by M. Vincent, one of the most distinguished of all authorities on international telegraphy, who has for many years represented Belgium at the Conference.

It would be fallacious to assume that the conditions which govern telegraphic correspondence are precisely the same as those which affect the postal traffic. It certainly does not follow that because the charge for the transmission of a letter over long distances has been brought down to a penny or two, and the result notwithstanding has been beneficial to the revenue, therefore a reduction of the telegraph tariffs from shillings to pennies would likewise pay. Postal work can be conducted on what may be called wholesale principles; telegraphs must be manipulated one by one. The real labour of a letter is performed by its writer, while in a telegram all is done by the departmental official. Roughly speaking, the carrying capacity of postal vans and mail steamers is unlimited, while that of a wire is restricted to so many words a minute. While, therefore, I cannot suppose that we shall ever transmit our telegrams as cheaply as our letters, I still venture to foretell a gradual but steady diminution in the tariffs as at present framed. Every mechanical invention which increases the working speed of our wires must tend to remove one of the principal obstacles to the growth of cheaper telegraphy. For my part, I would even advocate the freer employment of reasonable codes: I mean those made up of words of medium length, easy to send, and not liable to error, which necessitates repetition. I am bound to say that some of the secret words now used, especially on long lines of telegraph, are the reverse of reasonable, and

actually occupy the wire and worry the clerks far more than would the transmission of the full sentences for which these bewildering words are abbreviations. I should like to give you instances of some of the remarkable conglomerations which have come under my notice, but the time at our disposal would hardly admit of my spelling out any of the very long specimens.

A remarkable paper on the law of international telegraph traffic, by Mr. C. L. Madsen, our local honorary secretary for Denmark, was read before this society in April last. The object of that paper is to show the existence of a fairly uniform mathematical relation between the commercial and the telegraphic traffic of the several States. The entire question is one which deserves close and careful study.

Attempts have been made at different times to induce the Governments of Europe to declare the submarine and land lines of the world neutral in time of war. The United States, I believe, addressed a circular note on the subject, about seven or eight years ago, to the different Cabinets, and at Rome, in 1872, Mr. Cyrus Field, as representing the telegraph interests of America, laid the matter before the Conference, with a view to the insertion of some protective clause in the International Convention. The delegates, while admitting the desirability, from a philanthropic point of view, of such neutrality, if practicable, considered the discussion of the question to be beyond their functions. They, however, inserted a note in the *proces verbaux*, drawing the attention of their Governments to the application. Nine Governments replied: some commenting in a general way on the civilising tendency of the proposal, others referring to the replies they had previously sent to Washington. The result, as might perhaps have been anticipated, was that no decisive action has been taken in the matter.

I need not dwell at any very great length on the many other modifications which have been introduced into the Conventions of later years. They may be thus roughly summarised:—

The principal international offices must now be kept open throughout the twenty-four hours, and all extra night charges have been done away with.

A very large number of languages are now accepted as suitable for correspondence, it being, however, stipulated that every message when tendered be clearly written in the Roman character.

Permission is now freely accorded to all to employ cipher, or secret language.

The maximum length of a word which at first was no less than 7 syllables, is now 15 letters on the European, and ten letters on the extra European systems.

The franc has been universally accepted as the monetary unit in which all international accounts have to be prepared.

Rules have been drawn up to improve and regulate semaphoric communications with vessels at sea.

A complete system has been devised for the uniform settlement of traffic accounts between the several administrations, and sundry permissive clauses have from time to time been inserted, allowing separate administrations to make among themselves special arrangements which do not affect the other contracting States. This covers the introduction in some systems of what are called "emergent" messages, at treble rates, having the advantage of priority of despatch, also, on the other hand, of a cheaper class of despatch written on telegraph cards. The States are also empowered, if they please, to introduce, for the use of the Press, a system of subscription for the employment of unoccupied wires at reduced rates during certain hours of the night.

Every Convention since that of Brussels has been translated by Mr. Alfred Brasher, Superintendent in the Indo-European Telegraph Department. The translations were first made for the use of the Indian Telegraph officials only, but for the last ten years the Secretary of State has authorised their publication, and they have been adopted by the Post Office, the English companies, and, in fact, by all the English-speaking telegraph administrations in the world, without, so far as I know, any impeachment of their accuracy.

The headquarters of the International Telegraph Administration are at Berne, and the business has been for many years past conducted by M. Curchod, a gentleman of consummate tact and industry. His duties are by no means light, and I may say that the ability and courtesy with which they have been executed are gratefully recognised by every department concerned.

This central bureau receives and circulates notices of the opening of all new lines and stations, as well as of all interruptions and their rectification. To Berne are addressed all proposals for modification of rules or tariffs, which are then formulated and sent on to the different administrations interested. At the Berne office, too, are prepared new international tariffs and revised telegraph maps. It publishes a telegraphic journal, and the arduous task of arranging the materials for every fresh conference lies with the director, who invariably attends in a consultative capacity.

The expense of maintaining this central office at Berne is borne by the contracting States in different proportions, according to the importance of each administration.

Before the members of the conference disperse, they decide by vote where the next assembly shall take place. I am rather inclined to think that the conferences recur at too short an interval, and that a meeting once every five years would now be quite sufficient. Some twelve months before the date fixed for the new conference, the head of each administration is called on by the director of the central bureau to forward to Berne all proposals for change of regulation or tariff which it may be deemed desirable to discuss. The several proposals are carefully classified and circulated, so as to allow ample time for all to examine and criticise, and to make ready their arguments, whether favourable or adverse. At the appointed time, the delegates, armed with proper credentials from their respective Governments, present themselves at the selected place, and are formally received by some State Minister, who welcomes the visitors, and then instals in the presidential chair the Director-General, or some other official holding high rank in the telegraph service of the country where the conference is held. At Vienna the delegates were received by Count de Beust, and at Rome by Signor Visconti Venosta, both Ministers of Foreign affairs; at St. Petersburg by General Timatscheff, Minister of the Interior. The presidents at the three conferences were respectively M. Brunner de Wattenwyl, Signor de Amico, and General von Luders, and it would be hard to say to which of these admirable officers should be awarded the palm for the complete success which attended the arrangements.

It is obvious that a very great deal depends on the personal qualifications of the president, in whom should be combined patience, firmness, and courtesy, with a thorough knowledge of all the requirements of the telegraph organisations. He should, moreover, possess an intimate acquaintance with the actual working of the international rules.

I should here state that the British companies, to whom telegraphy owes so vast a debt, were strongly represented at Berne, Rome, and St. Petersburg. They had no voting power, but were at liberty to express their views fully and

freely, and I am sure they had no cause to complain of want of support or of inattention to their requirements.

The system usually followed at these conferences is to tell off the thirty or forty delegates into committees. One committee occupies itself with the revision of the rules, a second with the arrangement of the tariffs, and a third with the task of editing the Convention as a whole. The ordinary duration of a conference is from one to two months. The members meet three or four times a week, each sitting lasting from about ten in the morning until five or six in the evening. The work of the committees occupies the by-days. Throughout the deliberations the French language only is employed. These international telegraph conferences by no means consist of "all work and no play." At Rome and St. Petersburg every effort was made to entertain the visitors, and all the sights of these two capitals were thrown open to us. Banquets were given in our honour at the royal tables; special nights set apart for us at the operas, and so on. In Italy we were carried off in a body to Naples, and *fêted* most hospitably. A special excavation was arranged for us at Pompeii, and some amazing antiques and bronzes were brought to the surface. If I did happen to hear a few somewhat sceptical remarks about the authenticity of these treasures, I can at least honestly vouch for the genuine character of the sumptuous breakfast we found laid out in one of the pleasantest courts of the ruined city. In the same way, when in Russia, after we had for weeks enjoyed unbounded hospitality at the capital, we were invited to Moscow, and there received in the kindest way by the Prince-Governor and the local magnates.

I hope I shall be forgiven for having devoted a few words to what may be termed the festive aspect of these assemblies; but I consider that these agreeable reunions after the day's labour are of importance, and materially help the business of the conference. They tend to bring the delegates together, and many a hitch, which has appeared formidable at the ceremonious meeting in the morning, has been smoothed away by a friendly conversation over the evening cigar. Moreover, I wish to express my hope that the members of the conference of 1879 may be given in London the same cordial reception that they have experienced elsewhere; and I am happy to say that there is little doubt but that the Telegraph Engineers' Society will be well to the front in heartily welcoming our coming guests.

RISCH'S RELAY.

THE special peculiarity of this form of relay lies in the fact that it readily responds to and follows the variations in the positive and negative currents for working long land lines or submarine cables.

Fig. 1 represents a section, and fig. 2 a plan of one form of this relay. T, T^1 are two double sector tongues fixed on one axis *a*. These two tongues are either made permanently magnetic or have magnetism induced in them by the proximity of the poles of a magnet M, or they are temporarily magnetised by the line current passing through a coil 5 surrounding the axis *a*, the one tongue T being of opposite polarity to the other tongue T^1. Four coils, 1, 2, 3 and 4, arranged symmetrically with reference to the axis *a*, have their cores terminating in eccentric caps, by turning which more or less round, the distance between them and the arcs of the tongues can be adjusted. An arm A extends from the one tongue between two contact screws 6 and 7, which are on the upper end of an insulated lever arm 8 that is mounted on a pivot 9 with a light spring behind it to give friction, adjustable by a screw nut on the pivot. The coils 1, 2, 3, 4, are

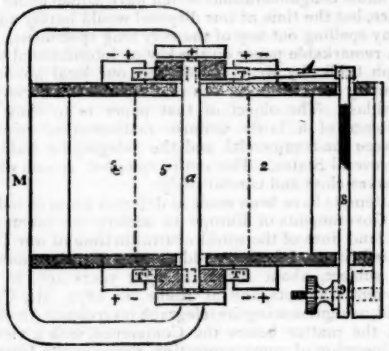


FIG. 1.

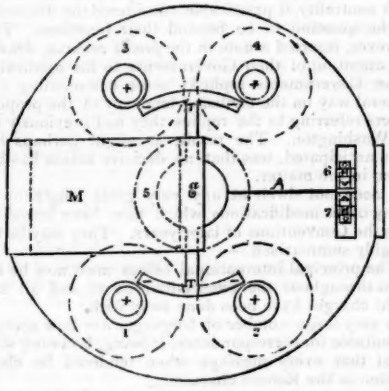


FIG. 2.

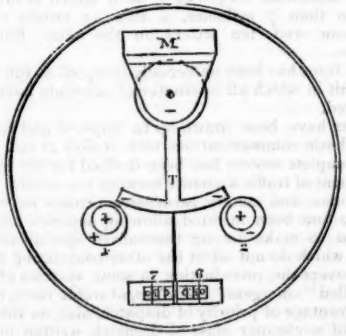


FIG. 3.

connected to the line, so that a current arriving by it increases the magnetic force of the one pair, such as 1 and 4, and diminishes or reverses that of the

other pair 2 and 3, whereupon the sector tongues are caused to deflect to the right or left, as the case may be, and the arm A makes contact with 6 or 7. When it makes such contact, as for example with 7, a continuation or increase of current, or a succession of long continued currents, alternating with short reversals, has the effect of pressing the arm A further and further in the same direction, and the contact 7 against which it bears, is thus moved

FIG. 4.

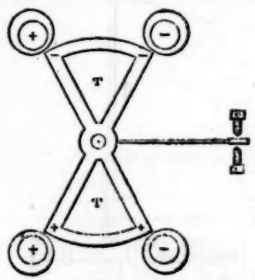


FIG. 5.

with the lever 8, bringing the other contact 6 along with it close behind the arm A, so that on a sufficient reversal of current the arm makes contact on the other side.

Fig. 3 shows the arrangement of a single sector tongue T (which may be of the form shown in fig. 4) with two electro-magnets 1 and 2, and contacts 6 and 7 on a lever, such as 8 in fig. 1.

Fig. 5 shows another form of double sector tongue operating with four electro-magnets.

SOME EFFECTS OF AMALGAMATION.

By F. HIGGINS.

MERCURY, although electro-negative to zinc in a voltaic combination, has the property in common with palladium, platinum, and nickel, of absorbing hydrogen, and assuming in consequence, the electro-positive polarity of the metal with which it is associated, provided that the potential be insufficient to disengage the hydrogen in the gaseous form.

A couple, consisting of amalgamated zinc and mercury, excited by sulphuric acid solution, will generate a current for a time dependent on the extent and nature of the surface of the mercury. This current will gradually diminish and cease, only from the assimilation of polarity caused by the absorption of hydrogen by the mercury.

If the mercury be pure and its surface smooth, the polarisation is much more complete than if it be rough, or contain any metal which is not very soluble in it, such as copper. In this latter case, the impurity floats to the surface in a finely divided state, and exposes points which greatly assist the formation and disengagement of bubbles of hydrogen.

Even when this roughness is caused by an excess of zinc, the mercury only very slightly protects the zinc from solution. On the other hand, the presence of lead or tin, which are very soluble and form smooth amalgams, does not appear to prevent the polarisation of the mercury, and does not facilitate the evolution of gas.

The action of an amalgamated zinc plate in a battery is probably, therefore, to a great extent of a secondary nature. The mercury dissolves and exposes zinc to the action of the acid, a voltaic couple is thus formed between the zinc and the mercury in its vicinity; the zinc necessarily oxidised and dissolved on this account is not, however, wasted, as in the case of continuous local action, but by its combustion lays up a store of electro-positive gas in the nascent state on the surface of the mercury.

The action resembles in a great measure that which takes place in a secondary battery, except that the loss in translation is much less in consequence of the absence of an external circuit, the whole force of the combination being exerted within the cell.

In proof of the oregoing suppositions, it has been found that an amalgamated iron surface, polarised by being placed in contact with a fragment of zinc, acts as well as a plate of zinc of the same size,* and, while affording the same conductive power as a large plate, the waste by local action is only proportional to the surface of zinc actually employed.

This arrangement has some advantages to recommend its employment, one of which is that the positive plate, or rather connection, can be a fixture in a battery, and may be in the shape of an amalgamated wrought or cast-iron cup, into which zinc may be dropped as required. Such a cup would be indestructible if kept supplied with zinc.

The diminution of internal resistance which may be thus effected in batteries is of great consequence: like the friction in a steam engine, the less there is of it the more power there is available for useful work without increased cost. But the most useful application of this property of amalgamated surfaces is to the protection of the connections of zinc plates from destruction.

An iron wire cast into a zinc plate will outlast the zinc; copper, on the contrary, is frequently attacked near the surface of the liquid, and the amalgamation of copper causes a steady destruction of zinc by local action from the before-mentioned property which it possesses of roughening the surface of the mercury in which it is dissolved.

If it were possible to amalgamate the armour of submarine cables it might perhaps increase their durability. Or the inner sheathing employed to resist the attacks of the teredo might be of a thin ribbon of amalgamated galvanised iron, which would have the great advantage over copper of not hastening or assisting the decay of the iron wires when, as would most likely be the case after the cable had been submerged some time, the two sheathings should come into contact.

RAPIEFF'S ELECTRIC CANDLE.

As soon as the ingenious discovery of Mr. Jablochkoff's "Electric Candle" was made known to the world, the attention of many electricians was

* This is only correct within certain limits. The zinc exerts its influence promptly over a radius of two inches, but more slowly as the surface is enlarged.

directed to it as the simplest existing electric lamp, with a view of ascertaining its real merits and defects. Early in the year 1877, M. J. Rapieff had an opportunity of making a series of experiments with the new candles, the generator of the current being an "Alliance" machine with six discs. On comparing the results obtained with the "candles"

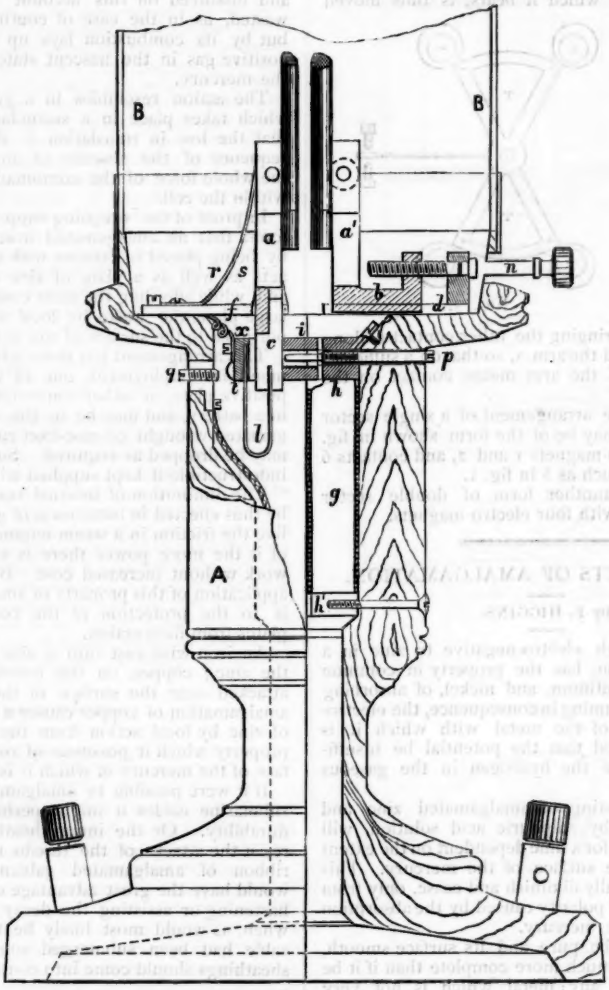


FIG 1.

and the Serrin regulator, fed by the same machine, he found that the illuminating power of the "candle" in its best conditions (3 candles) was at least one-third less than that of the light produced by the regulator. The steadiness of the light also was far from being satisfactory, although the occasional *momentary* flickerings were less noticeable in the candle than in the regulator; but the *gradual* decrease and gradual increase of the candle light was very marked, and the worst feature of all was the continuous variation in the tint of the light, from dark crimson to bluish green and violet. The chief merit of the candle was supposed to reside in its insulating strip of kaolin, as increasing the illuminating power of the voltaic arc, and preventing the flickering, thus making the electric light for the first time steady; but it was obvious that the defects of the "candle" lay almost entirely in this insulating substance. The kaolin strip being heated in the voltaic arc to incandescence, ceased to be an insulating substance, and became a conductor, and thus only a part of the current was utilised for producing the light, the remaining part passing

through the kaolin strips. The loss to the illuminating power of the candle so caused was also observable in the so called Jablochkoff's "Kaolin Light." This was the first application of the well-known physical fact that the most perfect insulators —such for instance as earthy substances—when heated, become more or less conductors, and M. Jablochkoff practically demonstrated this law by preparing a lamp, in which a sharp edge of a kaolin strip was brought to incandescence by means of a current of very great electro-motive force, supplied by an induction coil.

These considerations led M. Rapieff to construct a candle without any insulating material between the carbons, and he soon found that the voltaic arc tends of itself to keep the highest position between the free ends of the carbon points. This tendency of the arc is explained, first, by the draught of hot

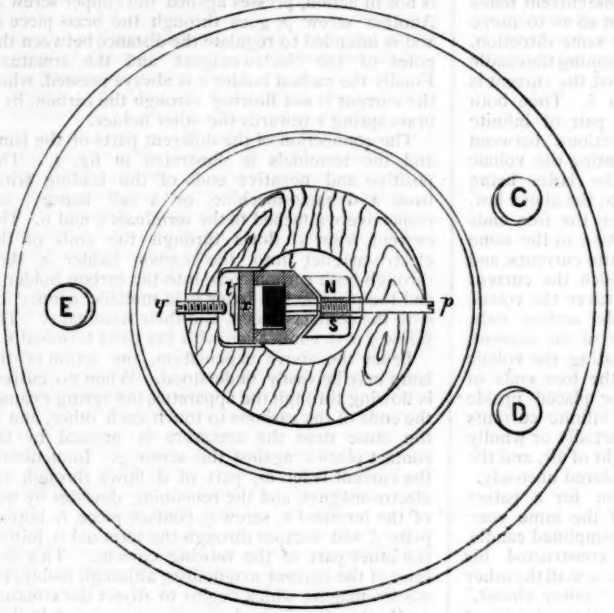


FIG. 2.

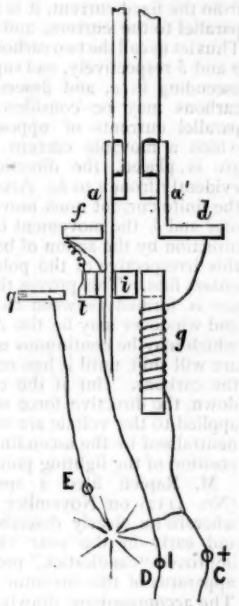


FIG. 4.

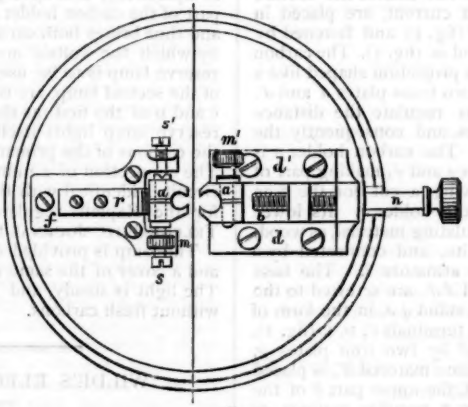


FIG. 3.

air caused by its heat, which draws it to the upper part of the carbon points, and, secondly, by the well-known law of electro-dynamics, according to which a finite movable current approaching a fixed infinite current is compelled to move in a direction parallel and opposite to that of the fixed current; and, on the other hand, if the movable current tends from the fixed current, it is acted on so as to move parallel to the current, and in the same direction. Thus let us call the two carbon rods forming the candle *a* and *b* respectively, and suppose that the current is ascending in *a*, and descending in *b*. Then both carbons may be considered as a pair of infinite parallel currents of opposite directions, between which a movable current representing the voltaic arc is placed, the direction of the latter being evidently from *a* to *b*. According to the above law, the finite current must move towards the free ends of *a* and *b*, the movement taking place in the same direction by the action of both infinite currents, and this irrespective of the pole by which the current enters first. This proves that wherever the voltaic arc is formed between two parallel carbon rods, and whatever may be the direction of the current, which may be continuous or alternating, the voltaic arc will shift until it has reached the free ends of the carbons. But if the candle be placed upside down, the directive force of both infinite currents applied to the voltaic arc either partially or wholly neutralised by the ascending draught of air, and the position of the lighting point is rendered unsteady.

M. Rapieff filed a specification for a patent (No. 4432) on November 24th of the same year, wherein he clearly described his simplified candle, and early in the year 1878, he constructed his improved "candlestick," provided, as are all the other apparatus of this inventor, with a "safety circuit." The accompanying drawings give all the details of this electric lamp.

The two carbon points of equal cross section for the alternative current, and one double the section of the other for the direct current, are placed in the carbon holders *a* and *a'* (fig. 1), and fastened by means of milled screws *m* and *m'* (fig. 3). The carbon holder *a'* is provided with a projection shaped like a dove-tail, sliding between two brass plates *d* and *d'*. A set screw *n*, enables to regulate the distance between the carbon holders, and consequently the length of the voltaic arc. The carbon holder *a* is is pivoted on conical screws *s* and *s'*, making part of the plate *f*, the latter having a cut for the free passage and movement of the holder *a*. Its lower part *c*, is made of some insulating material, as wood, vulcanised fibre, or ebonite, and connected by a steel spring *l*, to the iron armature *i*. The base plates of the holders *f*, and *d d'*, are screwed to the upper part of the wooden stand *a a*, in the form of a vase, which is fitted with terminals C, D, E (fig. 2). An electro-magnet, formed by two iron plates *g*, with a cross piece of the same material *h'*, is placed inside of the wooden stand, the upper part *h* of the two cores being shaped in a peculiar manner, as may be seen in fig. 2, showing the two poles N and S of the electro-magnet. This shape of the poles is found by M. Rapieff to be the most convenient and compact in order to secure the maximum of attractive power for comparatively large variations of the distance between the poles and the armature. The latter is an iron block, shaped like a horse-shoe, corresponding with the polar surfaces of the electro-magnet, thus allowing a free movement of the lower part of the holder *a*. A plate *k*, made of an insulating material, is fixed to both ends of the horse-shoe shaped armature, and this plate bears a metallic contact piece *t*, which, when the apparatus is not in action, presses against the copper screw *q*. Another screw *p*, goes through the brass piece *h*, and is intended to regulate the distance between the poles of the electro-magnet and the armature. Finally the carbon holder *a* is always pressed, when the current is not flowing through the carbon, by a brass spring *r* towards the other holder.

The connection of the different parts of the lamp and the terminals is illustrated in fig. 4. The positive and negative ends of the leading wires from a dynamo-machine, or a cell battery, are respectively attached to the terminals C and D. The current from C flows through the coils of the electro-magnet into the carbon holder *a*, then through both carbon rods into the carbon holder *a*, and the plate *f*; this latter is in metallic connection with the contact piece *t*, and their terminal *d*. The screw *q* is in connection with the third terminal E.

From the above explanation, the action of the lamp may be easily understood. When no current is flowing through the apparatus, the spring *r* causes the ends of the carbons to touch each other, and at the same time the armature is pressed by the contact piece *t* against the screw *g*. Immediately the current is let in, part of it flows through the electro-magnet, and the remaining deviates by way of the terminal E, screw *q*, contact piece *t*, bottom plate *f*, and escapes through the terminal D, joining the other part of the retiring current. This first inlet of the current magnetises, although feebly, the electro-magnet which begins to attract the armature *i*. By this, the derived circuit C, E, *q*, *t*, *f*, is broken, and now the whole current acts on the electro-magnet, and therefore on the armature *i*; the comparatively thin spring *l*, presses upon the lower part of the carbon holder *a*, overcomes the spring *r*, and thus brings both carbons into a parallel position by which the voltaic arc is established. When a reserve lamp is to be used, both terminals C and D of the second lamp, are connected respectively with C and D of the first (as shown in the fig. 4) and the reserve lamp lights itself automatically as soon as the carbons of the primary lamp have burned down. The connection of a number of such lamps in one circuit is identical with the arrangement employed for the Rapieff regulator, as described in the TELEGRAPHIC JOURNAL for November 1, 1878.

The lamp is provided with an opaline cylinder B, and a cover of the same material, as shewn in fig. 1. The light is steady, and lasts for about two hours without fresh carbons.

WILDE'S ELECTRIC CANDLE.

By HENRY WILDE.

IN a former communication to the Society,* I directed attention to the fact, that when the electric light is produced from the ends of two carbon

* See Proceedings of the Manchester Literary and Philosophical Society, Oct. 29, and Nov. 26, 1878.

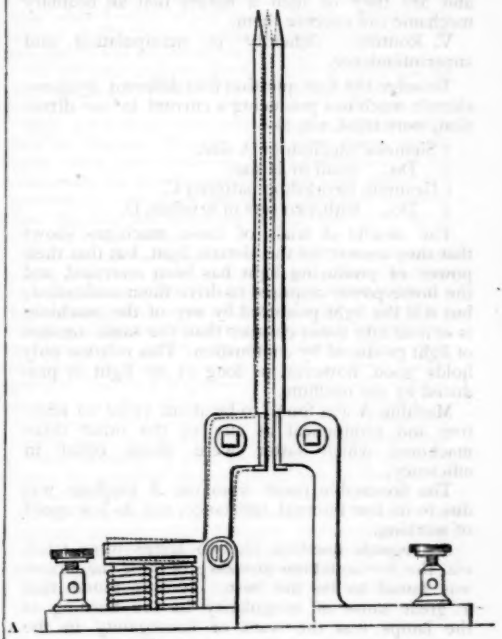
pencils placed parallel to each other, if the strength of the electric current, the thickness of the carbons, and the distance between them are rightly proportioned, the carbons will burn steadily downwards until they are wholly consumed, without any insulating material between them. To initiate the light by this method, it is necessary to complete the electric circuit between the carbons by means of some conducting substance, which volatilises on the passage of the current, and establishes the electric arc between the points.

When a number of such lights are produced simultaneously from the same source of electricity, any interruption in the continuity of the current extinguishes all the lights in the same circuit, and each pair of carbons requires to be reprimed before the lights can again be established. This defect, as will be obvious, would cause great inconvenience when the lights are not easily accessible, or are at considerable distances apart.

In the course of my experiments it was observed that when the electric circuit was completed at the bottom of a pair of carbons close to the holders, the arc immediately ascended to the points, where it remained so long as the current was transmitted. My first impression of this peculiar action of the arc was, that it was due to the ascending current of hot air by which it was surrounded. This however was found not to be the cause, as the arc travelled towards the points in whatever position the carbons were placed, whether horizontally or vertically in an inverted position. Moreover, when a pair of carbons were held in the middle by the holders, the arc travelled upwards or downwards to the points, according as the circuit was established above or below the holders. The action was in fact recognised to be the same as that which determines the propagation of an electric current through two rectilinear and parallel conductors submerged in contact with the terrestrial bed, which was described by me in the *Philosophical Magazine*, August, 1868.

In all the arrangements in general use for regulating the electric light, the carbon pencils are placed in the same straight line, and end to end. When the light is required, the ends are brought into momentary contact, and are then separated a short distance to enable the arc to form between them. The peculiar behaviour of the electric arc when the carbons are placed parallel to each other, suggested to me the means of lighting the carbons automatically, notwithstanding the fact that they could only be made to approach each other by a motion laterally, and to come into contact at their adjacent sides. To accomplish this object, one of the carbon holders is articulated or hinged to a small base plate of cast iron, A in the figure, which is so constructed as to become an electro-magnet when coiled with a few turns of insulated wire. The carbon holder is made in the form of a right-angled lever, to the short horizontal limb of which is fixed an armature placed over the poles of the electro-magnet E. When the moveable and fixed carbon holders are brought into juxtaposition, and the carbons inserted in them, the upper parts of the two carbons are always in contact when no current is transmitted through them, as shewn by the dotted lines in the engraving.

The contact between the carbons is maintained by means of an antagonistic spring inserted in a recess in one of the poles of the electro-magnet, and reacting on the under side of the armature. One extremity of the coil of the electro-magnet is in metallic connection with the base of the carbon holder, while the other extremity of the coil is in connection with the terminal screw at the base of the instrument from which it is insulated. The coils of the electro-magnet are thus placed in the same circuit as the carbon pencils.



WILDE'S ELECTRIC CANDLE.

When the alternating current from an electro-magnetic induction machine is transmitted through the carbons, the electro-magnet attracts the armature and separates the upper ends of the carbons, which brings them into their normal position, and the light is immediately produced. When the circuit is interrupted, the armature is released: the upper ends of the carbons come into contact, and the light is produced as before. When several pairs of carbons are placed in the same circuit, they are, by this arrangement, lighted simultaneously.

REPORT ON ELECTRIC LIGHT EXPERIMENTS.

By LOUIS SCHWENDLER.

THIS report was instituted on behalf of the Board of Directors of the East Indian Railway Company, the object being to determine whether the electric light could be employed with advantage for lighting the stations of the company.

The questions which Mr. Schwendler set himself to answer by *direct experiment* were five in number, viz. :—

I. Quantity of light per unit of power, unit of speed, and unit of money (first outlay).

II. Constancy and Regularity of the electric light.

III. How to put up the light—position and mechanical details.

IV. What repairs are required in course of time, and are they of such a nature that an ordinary mechanic can execute them.

V. Routine; difficulty of manipulation and superintendence.

To solve the first question four different dynamo-electric machines producing a current in *one* direction, were tried, viz. :—

1 Siemens' medium or A size.
1 Do. small or B size.
1 Gramme (workshop pattern) C.
1 Do. with two sets of brushes, D.

The results of trials of these machines' shows that they answer for the electric light, but that their power of producing light has been *overrated*, and the horse-power required to drive them *underrated;* but still the light produced by any of the machines is *at least* fifty times cheaper than the same amount of light produced by combustion. This relation only holds good, however, as long as *one* light is produced by *one* machine.

Machine A was found to be about twice as effective and economical as any of the other three machines, which latter were about equal in efficiency.

The favourable result from the A machine was due to its low internal resistance, and its low speed of working.

As regards question II, two lamps were tried, viz., the *Serrin* and the *Siemens;* of these the former was found to be the best. It was found that a great cause of irregularity in the burning of the lamps was the want of homogenity in the carbons.

Under the head of Question III., Mr. Schwendler gives his opinion that the *division* of the electric light is impracticable, except at a heavy loss. He considers the best way to diffuse the light is to throw it upwards by means of a *silvered glass* reflector on to a white ceiling or other convenient white surface.

The points considered under Questions IV. and V. were not unfavourable to the electric light system. The only repairs which seemed likely to be necessary were those affecting the brushes. The lamps were not likely to require much or difficult repairs. One skilled mechanic of rather high intelligence would be sufficient to look after the machines and lamps at any station.

Appendix I., which follows the general questions considered, gives a "General Specification of a Dynamo-Electric Machine required for use in India." The machine recommended is the A form, the induction cylinder being wound with twelve separate sections of wire. The speed of driving is to be from 700 to 750 revolutions per minute, and at that speed, through a known external resistance, the current produced *should not be less* than that given by the following formula :—

$$c = 0{\cdot}3\sqrt{\frac{w_1 - w_1}{m + r}}$$

where

c = current in webers;
w_1 = power in Meg. Ergs.* required per second to produce current c;
w_1 = power in Meg. Ergs.* required per second to drive the machine with the circuit open;
m = internal resistance of machine, } both in Siemens' units.
r = external resistance " }

The formula given allows a loss of 12 per cent. of power in producing the current.

The specification for the lamp states that the carbon holders are to be of the form adopted in the Siemens' lamp. With 18 mm. carbons the lamp should burn eight hours.

The electro-magnet which pulls the arc should not offer a greater resistance than ·02 Siemens' units. It is to be shunted with another electro-magnet of the same resistance. The amount of iron used in the electro-magnet should be such that at the mean distance of the electro-magnet from its armature the magnetic force is strong enough to produce an arc of 2·5 mm. against the mean tension of the spring when employing a current of 25 webers. The magnetic action of the shunt should be about double that of the lamp electro-magnet. The object of the shunt is to give the regulation movements great quickness, the currents from the magnets neutralising one another.

For adjusting the equality of the extra currents the following method is recommended :—

"Form a Wheatstone bridge two sides of which are formed by a mercury-rheostat, each side offering about 0·02 S.U. resistance. The third side of the bridge is formed by the electro-magnet of the lamp, the fourth side by the shunt. In one diagonal place a dynamo-electric machine and about *one unit* resistance, together with a convenient make-and-break contact, best done by a mercury cup. In the other diagonal, place a Bell-telephone of lowest possible resistance. One end of this diagonal can be moved along the mercury-rheostat. Start the dynamo-electric machine, listen to the telephone and alter the ratio of the mercury-branches of the bridge, by shifting along the contact until the telephone is perfectly silent.

Then if, at commencing and stopping the current a strong click is heard, we know it is due to the two extra currents not being equal, and as we further know that the shunt produces the greatest extra current, we make this extra current smaller, by shifting along the two poles of the shunt, an iron wedge until the telephone is quiet, when starting and stopping the current. The iron wedge is then fixed in its position."

In Appendix II., Mr. Schwendler considers the special conditions and information concerning the introduction of the electric light in India. The engine power for driving four dynamo-machines is not to be less than 25 horse-power. The speed indicator recommended is that of Napier.

(To be continued.)

* 7460·6 Meg. Ergs. per second, equal 1 horse-power per second.

Correspondence.

[We do not hold ourselves responsible for the opinions of our correspondents.]

CLERAC'S TUBE.

To the Editor of THE TELEGRAPHIC JOURNAL.

SIR,—Permit me on the occasion of a discussion now going on in your journal between Prof. Hughes and Prof. Barrett on the subject of the variable resistance carbon tube of M. Clerac, to inform you that I possess irrefutable proof of the existence of this tube which has been used since the year 1865 by M. Clerac, *employé* of the *Administration des lignes Telegraphiques Francaises*. One of the proofs is a letter of Prof. Hughes, dated 1866, in which he expresses his satisfaction at having in his possession a rheostat so simple and portable, whose indications are sufficiently exact for practical purposes. This letter bears the post mark, 1866. It runs as follows:

"Paris, Mars 4, 1866.

"MONSIEUR CLERAC,—Veuillez me faire construire quelques-uns de vos tubes de resistance variant de 100 jusqu'à 1000 kilometres.

"L'idée me parait excellent sur le rapport de l'economy, simplicité, et absence d' induction et polarization.

"Acceptez mes félicitations pour une si bon et simple invention.

"Sincèrement a vous,

[Pour copie conforme, "D. E. HUGHES.
M. du Moncel.]

I also heard of it myself at that time, but did not pay much attention to it, having regarded it as a consequence of the discovery that I had made in 1856 of the variation of the conductivity of semi-conductors under pressure. What astonishes me is that Professor Barrett, in a very good article on the Microphone in *Good Words* for October, 1878, expresses *himself as follows*:—

". . . . This, however, is not quite the case, for so long ago as 1856 Count du Moncel, a well known and most indefatigable French electrician, whilst investigating the electric resistance between the points of contact of two conductors (that is the greater or less freedom with which the current passes) found that the strength of the transmitted current varied with the amount of pressure exerted upon the surfaces in contact. Furthermore, in experimenting with brass, iron, platinum, and carbon conductors, M. du Moncel found that the effect of variations in pressure was most marked in bodies that had the highest electrical resistance; that is to say, in the worst conductors. Ten years later, in 1866, M. Clerac employed the foregoing principle in order to construct a simple machine for altering the strength of the current in a given circuit. This instrument, technically known as a rheostat, consisted of a tube filled with ordinary black lead or powdered carbon, and more or less compressed by a piston which was moved by a screw. In this way the resistance of the circuit in which the tube was introduced could be altered at pleasure."

At the time he wrote that, Professor Barrett took a right view; but since then he has allowed himself to be persuaded aside from it by M. Zetzsche, who, on this occasion as on several others, has shown that he is above all a Prussian, and wishes to claim all inventions for his own country, and who ought, however, to recall the proverb, "He who would prove too much, proves nothing."

I regret that Professor Barrett, for whom I have the greatest esteem, should allow himself to be impressed by Professor Zetzsche's claims, and that, contrary to his habits, he has gone astray. I can send him, should he desire it, the letter quoted above, which was in my hands before I published my note upon the ill-founded pretensions of Mr. Edison to that discovery.

I beg you to accept the assurance of my most distinguished sentiments,

DU MONCEL.

SIR,—Having read in your valuable paper the letter of Professor Hughes concerning Clerac's Variable Resistance Carbon Tube, I should like to be allowed to state what I know of the case. While perusing the account of Mr. Edison's inventions in the *Times* of the 2nd inst., I was astonished to read that—

"It has been said that Mr. Clerac discovered this ten years ago, but Professor Barrett has found no trace of this."

Well, as I had seen such a tube frequently used at our office by Professor Hughes, in a great many experiments which were made for the establishment of his instrument, in our communications with Paris and Amsterdam, I reminded him of the fact; but he (Professor Hughes) had forgotten that he had made use of this tube at our office.

With regard to the period when the Clerac tube was used by him, I am quite positive; for the reason that the communications with Paris and Amsterdam with the Hughes' instrument were officially opened on one of the first days of November, 1871 (the 4th, I think); and as it was during the preliminary experiments which were made daily for more than one month previous to that date that Professor Hughes used Clerac's tube, it must certainly have been in the course of October, 1871.

I remember very clearly that on one occasion Professor Hughes, requiring some external resistance, asked me if I had anything of that kind, and, on my negative answer, he produced a small tube four or five inches long, which he said would do. Naturally I asked him what it was composed of. "Simply," he replied, "of powdered carbon. It is the idea of Mr. Clerac" (a French employé at Paris, whom I knew by name as having attended Mr. Hughes' experiments).

Professor Hughes did not seem then to attach very great importance to it, except, as he explained to me, that it was a resistance variable according to pressure.

Subsequently I had occasion to see it used for the same purpose by Professor Hughes almost daily for a length of time, so that it is so clearly in my recollection that, although, more than seven years have elapsed, I am sure I could pick it, without hesitation, out of a hundred if it was again presented to me. Therefore I am happy to testify to the existence of this Variable Resistance Carbon Clerac Tube as far back, to my certain knowledge, as the dates above-mentioned.

F. DESPOINTES,
Superintendent Submarine Telegraph Co.
58, Threadneedle Street, London, E.C.
January 21st, 1879.

[The following letter reached us just in time for insertion in this number.—ED. T. J.]

SIR,—I am glad that Professor Hughes has, by his courteous letter in your last number, drawn attention to the statement made in a recent lecture in London and correctly reported in *The Times*, that I can find no trace of Clerac having made a carbon rheostat the resistance of which could be varied by pressure. Prof. Hughes' letter enables me to place before your readers the grounds on which I made the foregoing assertion. Anxious to arrive at an independent judgment upon the regretable dispute which arose upon the

discovery of the microphone, I made diligent search to find a record of Clerac's resistance tubes, which according to Prof. Hughes involved the principle Edison claimed when discovered. Count du Moncel's works and other authorities were searched in vain. At last a mutual acquaintance of Prof. Hughes and myself referred me to the *Journal Telegraphique* of Berne for 1874. To this I turned, and the following is the quotation from that journal for March 25th, 1874:—

"Dans son etude sur l'exposition historique de l'administration allemande, M. le Professeur Zetzsche parle, sans en indiquer l'origine de rheostats se composant de poudre de graphite comprimes dans des tubes de verre, qui seraient employés en Allemagne depuis 1865 dans les stations intermédiaires pour régler les résistances de la ligne (voir No. 26, du 25 Fevrier dernier, page 406.) M. Clérac, directeur des transmissions de 1re classe à l'administration des télégraphes français, nous écrit à ce sujet pour nous faire observer que ce rheostat est d'invention francaise et n'a pas été applique en Allemagne avant 1866. C'est M. Clérac qui vers la fin de 1865 à imaginé d'employer ainsi le charbon pilé et comprimé dans des tubes de verre, pour remplacer dans certains cas les bobines de résistance en fil de maillechort et c'est M. le Professeur Hughes qui frappé de la simplicité et de l'économie de cette invention, l'importa en Allemagne l'année suivant. Depuis, les rheostats à poudre de graphite ont été perfectionnés en France par la substitution de tubes en ébonite aux tubes de verre, ce qui simplifie la construction et augmente la constance."

It will be observed that there is no reference to any variable pressure exerted on the powdered graphite, it is simply stated that the carbon is "*compressed* in glass tubes as a substitute for resistance coils of German silver wire; and that Professor Hughes, struck with the simplicity and economy of the invention, introduced it into Germany the following year (1866)." Turning to the reference given in the quotation, we find in No. 26 of the same journal, these carbon rheostats spoken of as made to give a certain definite and permanent resistance. The obvious meaning of the passages in the *Journal Telegraphique* is that carbon rheostats of *constant pressure* and variable length were employed by Clerac; so that, unless there exists other documentary evidence of which I am unaware, I consider myself justified in asserting that to Edison is due the discovery of a carbon rheostat of *variable pressure*, with practically constant length, and that I could find no trace of Clerac having invented an instrument of this kind.

I was confirmed in this conclusion by the fact that before the lecture to which Professor Hughes refers I had published a similar opinion in a letter to the *Times*, in an article in *Nature*, and in a communication to the Physical Society. My statement not having been challenged, I have been much puzzled to account for the contrary opinion held by Professor Hughes, and felt sure either that some misunderstanding on his part existed, or that, more probably, I was ignorant of the whole facts of the case.

In his letter to your journal, Prof. Hughes states, what indeed I have heard before, that he has in his possession one of Clerac's variable resistance tubes, and that it has been seen by many. This I do not doubt. But I question whether this amounts to publication in the scientific sense, and further, it is important to know through what range of resistance this tube can be made to vary by simple pressure. On this point I may quote a letter I received some little time ago from Mr. Edison, to whom I had written, expressing my conviction that a misapprehension was at the root of the unfortunate controversy that had arisen, at the same time venturing to hope that he would feel justified in recalling the strong words he had used, as I understood Prof. Hughes had shown to several friends one of Clerac's original variable resistance tubes of carbon. Mr. Edison replied: "The statement that Clerac made resistance tubes with carbon, the resistance being varied by pressure, and which were said to have been used to regulate the resistance of telegraph lines, cannot possibly be true, for the reason that the amount of resistance that would be thrown in and out of the lines by the difference of pressure would be so small as not to be detected by any apparatus worked on telegraph lines. I have tried tubes of every size and character, with carbon in every degree of division, and no Morse apparatus would detect the change. I am thus led to conclude this is an after thought on the part of Mr. Hughes, and one which fortunately can be proved untrue. Undoubtedly Clerac made tubes filled with carbon which were adjusted to 50, 100, 500, or any number of ohms, but that he filled tubes with carbon and obtained these resistances by varying the pressure could not possibly be true in 1866, if it cannot now be done. Nothing has ever been published that I can find where Clerac claimed this."

From this extract it will be seen that Mr. Edison had good grounds for believing that he was the first to discover and make practical use of the variation of the resistance of graphite by pressure. And whilst I cannot entertain the opinion Edison has expressed concerning Prof. Hughes, I am bound to say that it behoves the latter to make public the evidence on which he has based his claim on behalf of Clerac.

Apropos of this subject, I may mention in conclusion, that an investigation which I have now in progress, undertaken to ascertain the cause as well as the amount of the diminution of resistance in carbon by pressure, indicates that it is no physical change but simply a case of more intimate contact. Particulars of these experiments will be published shortly.

W. F. BARRETT.

Royal College of Sciences,
Dublin, Jan. 25th.

[Mr. H.—Your letter will appear in our next.—Ed. T. J.]

Notes.

THE ELECTRIC LIGHT.—Prof. Tyndall lectured on the electric light at the Royal Institution on Friday, January 17, to a house crowded from floor to ceiling, and numbering in its audience many men and women of mark and rank. As was to be expected it was a complete success, for no lecturer knows better than Prof. Tyndall how to guide the popular mind to an understanding of science by apt words and well chosen illustrations. At the commencement of the lecture he said that his object was to put before his hearers "a few solid thoughts" regarding this question of the hour. Those who attended the lecture under the impression that the fate of fortunes hung on Prof. Tyndall's words, and saw in this statement a confirmation of their belief that he would give the law in the question of Gas *v.* Electricity, were doomed to disappointment, for the lecture was merely a masterly exposition of the origin, rise, and present state of electric lighting, and the lecturer merely echoed what all electricians conversant with the subject have held, namely, that the electric light would soon illuminate our streets, factories, and open spaces, and "*possibly* also" our homes. In fact, Dr. Tyndall said that he had come there that evening firmly resolved not to say a word that would influence gas shares if he could help it. As regards Edison's light he was prudently reticent, and took the position that as it was not yet

published he could not deal with it then, though at a future time he might. But, at the same time, he insisted on the erroneousness of terming Edison's light a "discovery," as is frequently done by our well-meaning friends, the newspaper reporters. It may be an invention, but it cannot be a discovery, says Dr. Tyndall, for all the laws of the subject have long been known. We will not stop to question this remark. The lecture was illustrated by diagrams and examples of all the principal magneto-electric machines, from Faraday's original arrangements up to the machines of Gramme, Siemens, and De Méritens, the latter of which he praised very highly, and proclaimed as a formidable rival to the two former ones. Various electric lights were also shown, the candles of Rapieff, Wilde, and Jablochkoff, and the arcs of Rapieff, Siemens, and Serrin. These experiments passed off very favourably, and we observed that the lamp of M. Rapieff, during the whole time it was exhibited (some minutes), did not give a single flicker. A large electric lamp hung from the ceiling, and, fed by a Siemens' machine, lit up the entire hall during the lecture, except when gas was required for producing what we may call a dim experimental light. The most interesting and beautiful of all the lights shown was, however, the irridium light, and being entirely unconnected with what Prof. Tyndall had to say about Edison's results, it was virtually a kind of side illustration of his doctrine that Edison has made no discovery. A small piece of irridium wire (which nevertheless was priced at £30) was heated to incandescence by the current from a Wallace-Farmer machine. Both the machine and the wire were furnished by Mr. Ladd, who has, we believe, joined a company for the supply of irridium. In a few moments after the machine was started the wire was lost in a rich mellow glow which illuminated the entire hall like evening sunlight. The golden effulgence excited the admiration of all, and many thought that it was no wonder Mr. Edison had been enthusiastic over such a light. The light is simply beautiful, but the cost is a different matter. One aim of Prof. Tyndall was to show how much the progress of electric lighting is due to Prof. Holmes, whom he called a "submerged inventor" for the reason that his work is so often lost sight of in these days; and he wound up his long lecture by an eloquent plea for the motives of inventors generally, and maintained that these men did not solely invent for the sake of gain, but often from the intellectual impulse of their genius. The mind of the inventor, he said, is like a vessel full of a saturated solution, which, when the proper fact is dropped into it, "becomes shot with the crystals of constructive thought."

SIEMENS' NEW ELECTRIC LAMP.—This novel lamp was first exhibited at the lecture above described. The improvement consists in dispensing with the negative carbon and substituting for it a hollow cone of copper kept cool by circulation of cold water within it. An examination of the voltaic arc shows that the light almost wholly emanates from the positive carbon, so that the negative need not be of this material. The copper is an excellent conductor, especially when kept cool, and it of course is permanent, so that the new lamp is an advantage in point of economy over the old Siemens' lamp. The principle involved in it of doing away with negative carbons is a new step likely to be of importance in electric lighting.

THE DYNAMO-ELECTRIC PRINCIPLE.—Touching the recent controversy as to whether Sir Charles Wheatstone, or Dr. Werner Siemens, or Mr. Varley priorly discovered this principle, Dr. Tyndall, in his lecture on the "Electric Light," laid down the law that the date of publicity must determine the priority, otherwise confusion would be the result.

ON January 4th, Professor Barrett delivered an interesting lecture on "Edison's Recent Discoveries," in the Hulme Town Hall, Manchester, in the course of which the carbon telephone was tried upon a line about a mile long, and persons at the further end of the line could hear the greater part of the lecture, although the speaker stood some ten or twelve feet from the carbon transmitter. Professor Barrett said that Mr. Edison's inventions were not merely clever contrivances, but generally contained some original observation in science which entitled him to the rank of a discoverer. In electric lighting, his discovery—and he (the lecturer) believed it to be such—enabled any one light to be raised or lowered at pleasure, without, in any way, interfering with other electric lights on the same main circuit."

IT is reported that Mr. Edison will soon visit this country.

LIVERPOOL AND THE ELECTRIC LIGHT.—At a special meeting of the Liverpool Town Council recently, it was resolved to obtain parliamentary powers for lighting the borough by electricity, and for purchasing the present gas company's works. A special envoy of the council reported on Mr. Edison's light which he had seen in America.

AMERICAN ELECTRIC LIGHTS.—A leading American electrician writes to us as follows:—"I know of no one here (whose opinion is worth anything) who has any confidence in the practical success of Edison's scheme. The way that the world stands agape waiting for the Edisonian mountain to bring forth its mouse is really absurd. I think you will be safe in not taking much stock of the greatly be-puffed electric light inventions of which the American newspapers are full. I have seen nothing yet as far advanced as what I saw at the Paris Exposition."

ON another page we give accounts of the electric candles of M. Rapieff and Mr. Wilde. Mr. Wilde found that to obtain a constant light from recent forms of the Jablochkoff candle, the alternating current supplied should in quantity and tension be such as to consume the candle at the rate of four or five inches per hour. If the current was too powerful the carbons were unduly heated and resisting; while if too weak, the arc flickered and was put out by air currents. Mr. Wilde also states that the plaster of Paris isolator did not always consume at the same rate as the carbons, and thereby obstructed the passage of the current, as was evident from the rosy tinge of the light produced by the volatilisation of the calcium simultaneously with the diminution of the brilliancy of the light from the carbons. Mr. Wilde, therefore, is of opinion that the isolator interferes with the regular consumption of the carbons under the alternating current. He suggests the employment of the carbon candle in the illumination of mines, by means of a powerful electro-magnetic induction machine, generating simultaneously alternating secondary currents in a number of small induction coils placed in various parts of the mine, the lights being enclosed in glass globes, having a small aperture to permit the egress of heated air, with wire gauze over it to prevent explosions.

PROF. MOSES G. FARMER, the well-known American electrician, now Professor of Electricity to the U.S.

Navy, delivered an interesting lecture at Newport, R.I., on Dec. 23rd last. He recalled the fact that during the month of July, 1859, he lighted his parlour with the electric light from two small lamps fed by a battery. The light was discontinued because at that time it cost four times the amount of gas. Mr. Farmer considered a room very well lighted with one candle-light to every 75 cubic feet of space. As regards the electric lighting of New York, he assumed, as a basis, each person to have a 10-candle light. Taking the population at a million, there would be required a total of 10 million candle-light power. When subdivided, the electric light, he estimated, would only yield 500 candles per horse-power, and therefore 20,000 horse-power would be required to light the city. It would not be advisable, he said, to have dynamo-machines giving more than 5,000 candles each, for fear of them getting out of repair. Thus 2,000 machines would be required, and some 20,000 lamps. A new electrical corps would be necessary to superintend the lines and apparatus. If the light was only to be used during an hour or two out of the twenty-four, the cost of interest and depreciation of plant might exceed the cost of power consumed. In the course of his lecture Prof. Farmer ventured the opinion that "in five years from now there will be more gas consumed than there is to-day," judging from the stimulus which the electric light will give to improved gas lighting and heating.

As early as 1844, Dr. Draper used a strip of platinum, heated by the electric current, to determine the facts that all solid substances became incandescent at a temperature of 977° Fah., and that the light given out increases in refrangibility and intensity, the order of rays emitted being that of the prismatic spectrum, as the temperature rises. Dr. Draper also proposed a "unit lamp," which should consist of a strip of platinum one inch long by one-twentieth inch wide, connected to a lever by which its expansion might be measured. This lamp would yield at 2,000° Fah. a convenient unit light. It could be ingeniously kept at constant temperature irrespective of the source, and fractions of the luminous surface could be utilised instead of the whole. Mr. W. H. Preece has pointed this out in *Nature*.

THE steamers plying on the Weser and Elbe are to be fitted with electric lights. When will some of our London shipowners follow their example? How would an electric beam, shot through our smoky atmosphere vertically upwards, serve as a luminous signal for vessels in the Thames? With such a device, disasters such as that of the *Princess Alice* might be averted. In thick foggy nights or days, when the danger is greatest, the track of the light would be best seen.

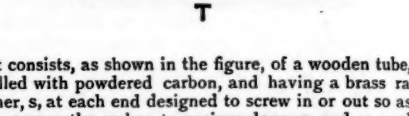
THE Marston Rock Salt Mine, Cheshire, has been lit by electricity, a Siemens' machine and Marshall engine being employed. The mine is several acres in area, the roof being stayed by pillars of salt. The lustrous effect of the light on the white sparkling salt is very fine. The arrangements were made by Messrs. Welch and Scott, Manchester.

THE Library of the British Museum is to be lit by electricity.

THE WALLACE-FARMER LIGHT.—The parallel arrangement of the carbons in this lamp were described and illustrated by a Mr. W. Gillespie in the *Mechanics' Magasine* for May 26, 1849. There is no account, however, of an automatic regulator for adjusting the distance of the carbons; this is merely done by a clamping screw.

STREET GAS-LIGHTING.—The competition of the electric light has at length stimulated the gas companies to supply better street lamps. The Chartered Company purpose replying to the Holborn Viaduct and Embankment electric lights by fitting Mr. Sugg's 200 candle burners to certain lamps in Waterloo-place. With these burners the jet is formed of concentric argand cylinders of flame, as many as five being used in the 500 candle burner, and the hot air ascends through a ventilator at the top, while the cold air descends from the top also, and is passed up between the flames. The lamp being closed at bottom, the flame is shielded from the wind, and hence is steady in the roughest weather. The lamp will be screened above by an opal reflector to throw down much of the light now lost in the sky, and no shadow will be lost by the lamp frame. These powerful gas lights are economical, for gas is said to yield a greater proportion of light per cubic foot as the quantity per hour is increased.

CLERAC'S TUBE.—This small instrument has acquired some historical importance in connection with the inventions of the microphone and carbon telephone, inasmuch as its use is based on the variable resistance of powdered carbon under pressure, a fact observed by M. Clerac, its inventor, as far back as 1865. Professor Hughes has had one of the earliest of these tubes—that illustrated below—in his possession since 1866



It consists, as shown in the figure, of a wooden tube, T, filled with powdered carbon, and having a brass rammer, S, at each end designed to screw in or out so as to compress the carbon to various degrees, and so modify its resistance. These screws also serve for terminals. A small touch-hole had been drilled by M. Clerac in the side of the tube to enable the operator to poke the carbon should it tend to cake inside; but Professor Hughes stopped it up with a tack to serve as an intermediate terminal. It is a very simple, even rude appliance, but it served its purpose admirably, and that was, to be a portable high resistance, variable at will within required limits. It was used by Professor Hughes in fitting his type-printer to different long lines in England and abroad, so that it has been carried about and shown by him in almost all the countries in Europe. Insignificant as it is, it contains the principle of the variation of the resistance of ground carbon under pressure, claimed for Mr. Edison as a novel discovery in 1873; but in 1866 there was apparently so little need of such an appliance, that Professor Hughes advised M. Clerac that the sale of these tubes would not recoup the expenses of a patent. To ensure the authorship of the invention to M. Clerac, however, a letter was written by Professor Hughes to him, acknowledging the receipt of the tube, above represented, and describing it. This letter was posted without an envelope in order that the postal stamp might certify its date. M. Clerac still possesses this letter. Clerac subsequently made many such tubes of glass, ebonite, and wood, with screws of different forms, some having probes to pierce the powder so as to loosen it when the probe was withdrawn. Through the courtesy of Professor Hughes, we have been enabled to test the Clerac tube, or variable carbon rheostat, in his possession, using both a galvanoscope and a speaking tele-

phone as the test instruments, and we found that with the rheostat in circuit, the deflection of the needle in the one case and the intensity of the sound in the other *gradually* died away as the screw operated upon was eased outwards, that is as the pressure on the carbon in the tube was diminished. From some 5,000 ohms as its lower limit the resistance could be increased to infinity.

WHILE upon this subject we may call to mind the researches of M. du Moncel (published in 1855) upon the variation of contact resistances under pressure, and it is worthy of mention that Professor Hughes in 1867-8, found the metal contacts of the chariot of his type-printer so to vary with the pressure of the spring on them, that he had to adopt another plan. This fact was at that time well known.

THE TELEPHONE has been generally adopted in the Californian mines, some of which have lines 30 miles long. It is also employed in the great Comstock bullion mine.

THE TELEPHONE is to be employed by the divers of the New York Department of Docks, Edison's being the transmitter.

MR. W. CHANDLER ROBERTS, F.R.S., the pupil and successor of the late Professor Graham as Chemist to the Mint, delivered, on Jan. 22, the first of the series of triennial "Graham" lectures, inaugurated by the Glasgow Philosophical Society. His subject was "Molecular mobility, or some forms of invisible motion," and he illustrated the diffusion of gases by rendering the molecular impacts audible through means of a microphone.

THE PHONOGRAPH.—The Abbé Carbonel, of the Belsunce School, Marseilles, has been experimenting with the phonograph, and concludes that the recording and rehearsing diaphragms should be distinct, the former having a very sonorous plate operating on very stiff, hard foil, the latter a delicate membrane like that of the ear. The foil could be made from a copper band thinly coated with wax to take the impression, and corroded afterwards by acid so as to obtain a hard metal cast; but this is necessarily a defective process. The Abbé therefore employs albumen spread upon paper or other base, instead of the wax applied to the copper. The soft albumen record is afterwards hardened in a well-known manner, and a hard matrix, whose dints vary in depth with the intensity of the sound, is obtained. As a means of reproducing the sounds he suggests the use of Savart's wheel instead of a vibrating plate.

THE Central American republics of Costa Rica, Nicaragua, Guatemala, and Honduras, from San Juan del Sur to Mexico, have been put into telegraphic communication with each other by completion of the section of line between Chichigalpa, Nicaragua, and the boundary line of Honduras.

THE 1879 Session of the Society of Telegraph Engineers was opened on January 22, by the address of the president, Major Bateman-Champain, R.E. Among the papers proposed to be read during the term are the following:—"On the working of long submarine cables," by Willoughby Smith; "A new determination of the ratio of the electro-magnetic to the electrostatic unit of electric quantity," by Professors Ayrton and Perry; "On curbed signals for long cables," by James Greaves; "On the establishment of relay stations for the purpose of expediting telegraphy," by W. H. Preece; on "Electric intercommunication on railway trains," by C. V. Walker, F.R.S.; on the "Electric light; its past, present, and future," by Lieut.-Col. Bolton and W. H. Preece; "On the soaking out of the residual charge in a Leyden jar," by Professors Ayrton and Perry; and on "Colonial telegraphs," by J. Sievewright, M.A. We understand that Professor Hughes will also read a paper dealing with the induction on telegraph lines.

POSTAL OFFICIALS AND LITERATURE.—About two years ago the Post-office and telegraph officials belonging to the East London District, instituted a Circulating Library and Literary Institute. This has been found a boon to this numerous class, who, unable to pay for standard works of literature, not being within the area of any good circulating library, and comprehending a large proportion of young persons with small salaries, are now, at an outlay of a halfpenny a week for telegraph messengers and a penny for letter-carriers and others, supplied with the best literature existing, including the chief periodicals that are issued. The boy telegraph messengers alone in the district read 1,440 volumes, besides numerous magazines, during the seven months ended November last, a very encouraging fact when it is to be remembered how such lads as these are catered for by the publishers of boys' literature. The institute feels the want of such articles as wall maps and pictorial illustrations of the arts and sciences. The committee are extending their operations in the establishment of a mutual improvement society, with lectures and classes, and as the subscriptions will scarcely meet the necessary expenses they make a modest appeal to the public for assistance. Presents of books and pecuniary aid will be thankfully received by the secretary, Mr. F. H. Parsons, at the District Office, Commercial-road, E.

MUIRHEAD AND WINTER'S QUADRUPLEX.—This novel system of quadruplex is working very successfully on the trans-Indian line, between Madras and Bombay. It is a split battery system, and promises to be superior to Edison and Prescott's. We are obliged to reserve a full account of it until the patents are secured, but will do so then. The advantages claimed for it are (1) that considerable change in the resistance of the line do not disturb the balance; (2) that the receiving instruments do not require to be differentially wound, and (3) that there is no loss of current-power from the use of a Wheatstone Bridge.

City Notes.

Old Broad Street, Jan. 29, 1879.

THE directors of the Anglo-American Telegraph Company (Limited) have resolved (after placing £37,500 to the credit of the Renewal Fund) to recommend to the proprietors of the next half-yearly general meeting of the company, to be held on the 7th February next, the declaration of the following dividends, all free of income tax:—1. A balance dividend of 1½ per cent. upon the ordinary Consolidated Stock for the half year ended Dec. 31, 1878. 2. A first and final dividend of 3 per cent. on the Deferred Stock for the year ended Dec. 31, 1878. After paying the foregoing dividends there will be a balance of about £3,587 to be carried forward to the next

account. The above dividend, together with those already paid, amount to 4½ per cent. upon the ordinary Consolidated Stock of the company for the year 1878.

The directors of the Direct United States Cable Company have resolved upon the payment of an interim dividend of 5s. per share, being at the rate of 5 per cent. per annum, for the quarter ending 31st December 1878, such dividend to be payable on and after the 15th February.

The report of the directors of the Eastern Telegraph Company, to be presented to the Thirteenth Ordinary General Meeting, 30th January, 1879, shows the Company's revenue for the six months ended 30th September, 1878, amounted to £207,347 19s. 6d., from which is deducted £56,339 17s. 3d. for the ordinary expenses of the Company, and £20,154 3s. 3d. for special expendiure during the half year, as shown in the annexed accounts, which, with £2,726 2s. 6d. for income-tax, leaves the sum of £128,127 16s. 6d. net profit. From this amount, £32,269 13s. 2d. the interest on debentures and the dividend on the Six per Cent. Preference Shares to 30th September, together with two interim dividends on the ordinary shares for the quarters ending 30th June and 30th September, 1878, amounting together to £92,425, have been paid, leaving a balance of £3,433 3s. 4d. to be carried forward. The several sections of the Company's cables remain in good working order, with the exception of the Lisbon Cable, which is now under repair. The Company's cable repairing ships, stationed in the Mediterranean and the Red Sea, are in efficient condition, and in readiness for the Company's requirements. The Joint Purse Agreement between the Indo-European Telegraph Department of H.M. Indian Government, the Indo-European Telegraph Company, and this Company, continues to work satisfactorily. By the resolution of the Extraordinary General Meeting of Shareholders, held on 9th August last, the directors were empowered to acquire the shares and undertaking of the Black Sea Telegraph Company (Limited), and to raise capital for the purpose; and for the laying of a new cable between Alexandria and the Island of Cyprus. The transfer of the shares of the Black Sea Telegraph Company has been completed, and the cable (from Constantinople to Odessa) is now worked as part of this Company's system. In accordance with arrangements made with H.M. Government the Company has connected Cyprus with Alexandria by cable, and is now constructing land lines in the island. The capital required for the new works has been raised by an issue of five per cent. debentures, payable 1st August, 1887, of which £181,900 has been issued to the shareholders up to this date. Two of the directors, the Marquis of Tweeddale (Lord W. M. Hay, M.P.) and the Right Hon. W. N. Massey, M.P., retire by rotation, and being eligible, offer themselves for re-election.

The report of the directors of the Western and Brazilian Telegraph Company, to be presented at the sixth ordinary general meeting, 31st January, 1879, states the total earnings of the year amounted to £92,882 1s.; the working expenses (including £1,737 3s. 3d. rebate on issue of A, B, and C debentures) charged to revenue were £72,552 4s. 2d., which, together with £17,066 7s. 8d. interest for the year on the A, B, and C debentures, gives a total of £89,618 11s. 10d., leaving a net balance of £3,263 9s. 2d. to the credit of revenue account. It goes on to say:—"The ordinary working expenses show a reduction as compared with last year. The expenditure on account of maintenance and renewals exhibits on the other hand a very considerable increase. The revenue shows a falling off, compared with the previous year, of £5,652 15s. 11d. The general stagnation in commercial affairs will in part account for this, and the numerous interruptions of the company's cables have also influenced the revenue. The revenue account is subject to the settlement of the question raised by the Brazilian Submarine Company as to whether, in consequence of the lengthened interruption of the Pará-Pernambuco section, this company should participate to the extent of one-third in their gross receipts, as provided by the agreement existing between the two companies. It has therefore been necessary to estimate the amount due under this agreement. The expenditure on maintenance and renewal account this year charged against revenue has been £38,194 6s. 10d. The repairs and the extensive renewals effected have involved an expenditure of £69,194 6s. 10d., of which £38,194 6s. 10d. has been directly charged to revenue, and £31,000 to renewal account. The directors regret that so small a net revenue has been earned; a very great permanent improvement has been effected in the lines by the substitution of sheathed cable for that originally laid down; and although more work in the same direction still remains to be done, your cables are more secure and are working better, with greatly improved chances of unbroken communication. The directors commenced proceedings against Mr. Heugh, the late chairman of the company, for sums of money which the Board are advised he is accountable for, and these proceedings are being continued under the bankruptcy."

The Globe Telegraph and Trust Company (Limited) announce the payment, on and after February 7, of interim dividends for the quarter ending 18th January of 3s. per share on the Preference Shares, being at the rate of 6 per cent. per annum, and 2s. per share on the Ordinary Shares, being at the rate of 4 per cent. per annum.

The Eastern Extension Telegraph Company have given notice that the half-yearly coupons on their Six per Cent. Debentures, due on the 1st proximo, will be payable on and after that date, at the Consolidated Bank.

On Jan. 24th the Indo-European Telegraph Company notified that "The Black Sea direct cable from Odessa to Constantinople being restored, communication is now re-established by the special Indo-European route to Turkey."

The managing director of the Brazilian Submarine Telegraph Company (Limited) states that their cable to Madeira is working perfectly, and that there is no interruption either on the lines or cables of the Eastern Telegraph Company between London and their terminus at Lisbon.

The following are the latest quotations of telegraphs:—Anglo-American, Limited, 58½-59; Ditto, Preferred, 84-85; Ditto, Deferred, 33-34; Black Sea, Limited, —; Brazilian Submarine, Limited, 6½-6¾; Cuba, Limited, 8¾-9¼; Cuba, Limited, 10 per cent. Preference, 15¼-15¾; Direct Spanish, Limited, 1½-2; Direct Spanish, 10 per cent. Preference, 9¾-10¼; Direct United States Cable, Limited, 1877, 11¼-11½; Eastern, Limited, 7-7¼; Eastern, 6 per cent. Debentures repayable October, 1883, 104-107; Eastern 5 per cent. Debentures repayable August, 1887, 102-105; Eastern, 6 per cent. Preference, 11-11¼; Eastern Extension, Australasian and China Limited, 7-7¼; Eastern Extension, 6 per cent. Debenture, repayable February, 1891, 107-110; German Union Telegraph and Trust, 7⅜-8½; Globe Telegraph and Trust, Limited, 5-5¼; Globe, 6 per cent. Preference, 10⅜-10⅝; Great Northern, 7⅞-8⅛; Indo-European, Limited, 2¾-3¼; Mediterranean Extension, Limited, 2¾-3¼; Mediterranean Extension, 8 per cent. Preference, 9-9½; Reuter's, Limited, 10-11; Submarine, 217-222; Submarine Scrip, 2-2¼; West India and Panama, Limited, 1¼-2⅛; Ditto, 6 per cent. First Preference, 8-8½; Ditto, ditto, Second Preference, 7½-8; Western and Brazilian, Limited, 2½-3; Ditto, 6 per cent. Debentures "A," 88-90, Ditto, ditto, ditto, "B," 85-89; Western Union of U.S. 7 per cent., 1 Mortgage (Building) Bonds, 114-118; Ditto, 6 per cent. Sterling Bonds, 101-103; Telegraph Construction and Maintenance, Limited, 30-31; Ditto, 6 per cent. Bonds, —; Ditto, Second Bonus Trust Certificates, 2½-2⅝; India Rubber Co., 9¼-9½.